Quick poll $\int_2^k x^2\,dx = 0$

↑

function of k

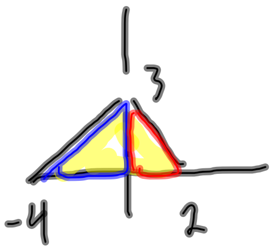
$$\left.\frac{x^3}{3}\right|_2^k = 0 \qquad k = 2$$

$$3\left(\frac{k^3}{3} - \frac{2^3}{3} = 0\right)$$

$$k^3 = 8$$

Nov 19-9:10 AM

15



$$\bar{y} = \frac{1}{2-(-4)}\boxed{\int_{-4}^{2} f(x)\,dx}$$

area

$$\bar{y} = \frac{1}{6}\left(\frac{1}{2}\cdot 6\cdot 3\right) = \frac{9}{6} = \frac{3}{2}$$

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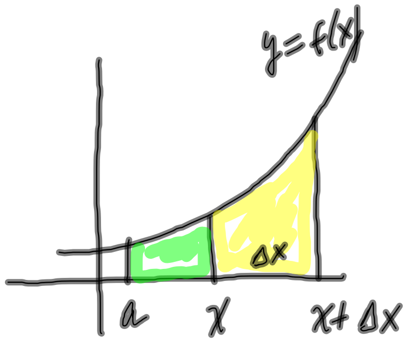
5.4 Proof & use of the FTC



shaded area = ΔF

we noticed:

$$\lim_{\Delta x \to 0} \frac{\Delta F}{\Delta x} = f(x)$$

y

$F(x)$ area function
(area from a to x)

$$\Delta F = F(x+\Delta x) - F(x)$$

$$\lim_{\Delta x \to 0} \frac{F(x+\Delta x) - F(x)}{\Delta x} = f(x)$$

$$\boxed{F'(x) = f(x)}$$

FTC says F is an antiderivative of f

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restate FTC

version I

$$\boxed{\frac{d}{dx}\int_a^x f(t)\,dt = f(x)}$$

$$\frac{d}{dx} F(x) = f(x)$$

$$F'(x) = f(x)$$

version II

$$\int_a^b f(x)\,dx = F(b) - F(a)$$

where $F(x)$ is an antiderivative of $f(x)$

Nov 19-10:01 AM

$$\frac{d}{dx}\int_{-\pi}^{x} \underbrace{\cos t}_{f(t)}\, dt = \cos x$$

$$\frac{d}{dx}\int_{0}^{x} \frac{1}{1+t^2}\, dt = \frac{1}{1+x^2}$$

Nov 19-10:08 AM

37. $$\int_{\pi/4}^{3\pi/4} \csc x \cot x \, dx = -\csc x \Big|_{\pi/4}^{3\pi/4}$$

use version II

$$= \frac{-1}{\sin\frac{3\pi}{4}} + \frac{1}{\sin\frac{\pi}{4}}$$

$$= \frac{-1}{\sqrt{2}/2} + \frac{1}{\sqrt{2}/2}$$

$$= 0$$

Nov 19-10:12 AM

44 find the total area bounded by

$y = x^3 - 4x$ and the x-axis on

$[-2, 2]$

$$\int_{-2}^{2} x^3 - 4x \, dx = \frac{x^4}{4} - 2x^2 \Big|_{-2}^{2} = \left(\frac{2^4}{4} - 2\cdot 2^2\right) - \left(\frac{(-2)^4}{4} - 2(-2)^2\right)$$

$= 0$

Nov 19-10:18 AM